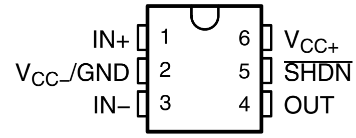
LMV981 SINGLE, LMV982 DUAL 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT AND SHUTDOWN

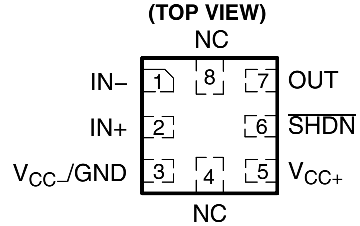
SLOS440H – AUGUST 2004 – REVISED JULY 2007

- **1.8-V, 2.7-V, and 5-V Specifications**
- **Rail-to-Rail Output Swing**
  - **600-Ω Load . . . 80 mV From Rail**
  - **2-kΩ Load . . . 30 mV From Rail**
- **V_{ICR} . . . 200 mV Beyond Rails**
- **Gain Bandwidth . . . 1.4 MHz**
- **Supply Current . . . 100 μA/Amplifier**
- **Max V_{IO} . . . 4 mV**
- **Turn-On Time From Shutdown . . . 8.4 μs**
- **Space-Saving Packages**
  - **LMV981: SOT-23-6, SC-70, and QFN**
  - **LMV982: MSOP and VSSOP**
- **Applications**
  - **Industrial (Utility/Energy Metering)**
  - **Automotive**
  - **Communications (Optical Telecom, Data/Voice Cable Modems)**
  - **Consumer Electronics (PDAs, PCs, CDR/W, Portable Audio)**
  - **Supply-Current Monitoring**
  - **Battery Monitoring**

LMV981 . . . DBV (SOT23-6) OR DCK (SC-70) PACKAGE
(TOP VIEW)

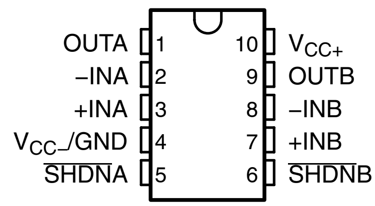


LMV981 . . . RUG (QFN) PACKAGE
(TOP VIEW)



NC – No internal connection

LMV982 . . . DGS (VSSOP/MSOP) PACKAGE
(TOP VIEW)



description/ordering information

The LMV981 and LMV982 devices are low-voltage, low-power operational amplifiers that are well suited for today's low-voltage and/or portable applications. Specified for operation of 1.8 V to 5 V, they can be used in portable applications that are powered from a single-cell Li-ion or two-cell batteries. They have rail-to-rail input and output capability for maximum signal swings in low-voltage applications. The LMV98x input common-mode voltage extends 200 mV beyond the rails for increased flexibility. The output can swing rail-to-rail unloaded and typically can reach 80 mV from the rails, while driving a 600-Ω load (at 1.8-V operation).

ORDERING INFORMATION†

T_A	PACKAGE‡			ORDERABLE PART NUMBER	TOP-SIDE MARKING§
–40°C to 125°C	Single	QFN (RUG)	Reel of 3000	LMV981IRUGR	R7
		SOT-23 (DBV)	Reel of 3000	LMV981IDBVR	RBA_
			Reel of 250	LMV981IDBVT	PREVIEW
		SC-70 (DCK)	Reel of 3000	LMV981IDCKR	R7_
			Reel of 250	LMV981IDCKT	PREVIEW
	Dual	MSOP/VSSOP (DGS)	Reel of 2500	LMV982IDGSR	RCB
			Reel of 250	LMV982IDGST	

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
‡ Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
§ DBV/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

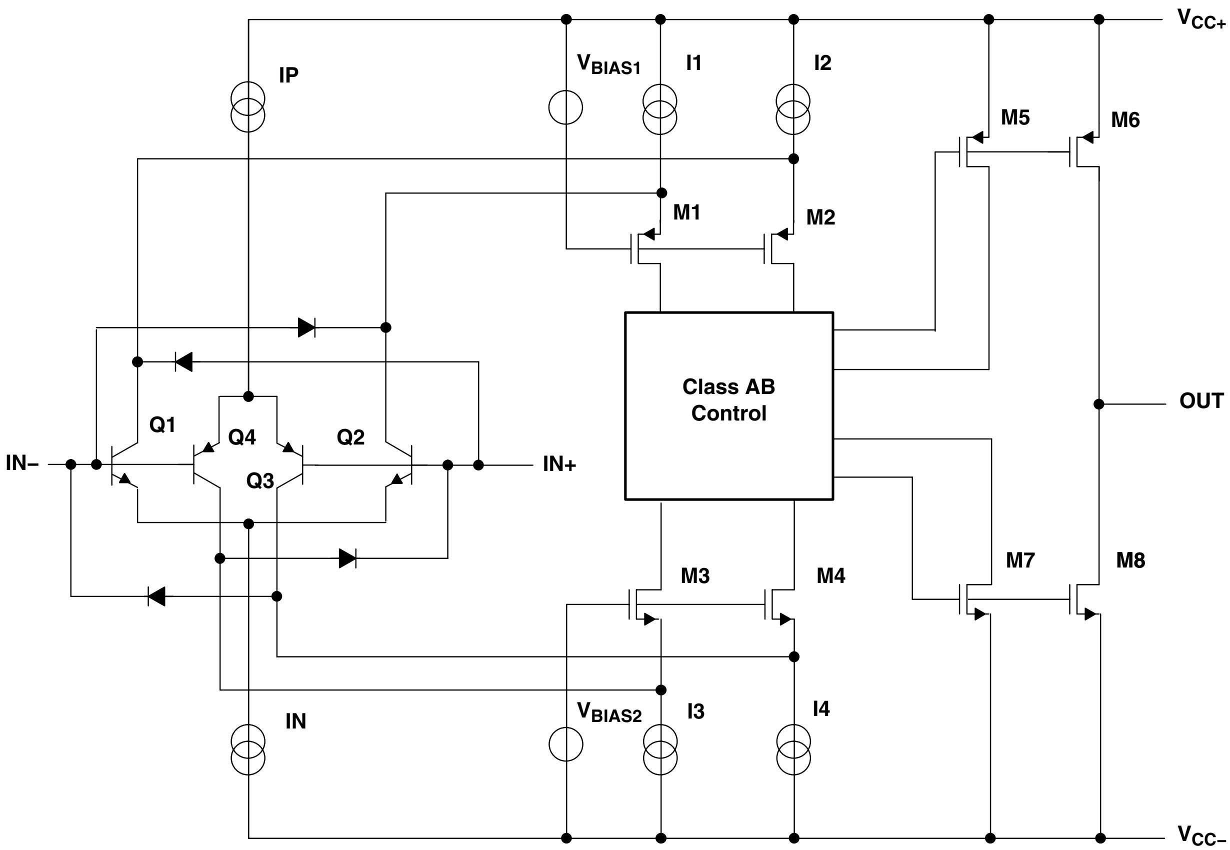
description/ordering information (continued)

The LMV981 and LMV982 devices offer shutdown capability for additional power savings. Pulling the SHDN pin low puts the amplifiers in shutdown, where only 0.156 μA typically is consumed from a 1.8-V supply. In normal operation with the same 1.8-V supply, the devices typically consume a quiescent current of 103 μA per channel, and yet they are able to achieve excellent electrical specifications, such as 101-dB open-loop DC gain and 1.4-MHz-gain bandwidth. Furthermore, the amplifiers offer good output drive characteristics, with the ability to drive a 600-Ω load and 1000-pF capacitance, with minimal ringing.

The LMV981 and LMV982 devices are offered in the latest packaging technology to meet the most demanding space-constraint applications. The LMV981 is offered in standard SOT-23 and SC-70 packages. The LMV982 is available in the 10-pin MSOP package.

The LMV98x devices are characterized for operation from –40°C to 125°C, making them universally suited for commercial, industrial, and automotive applications.

simplified schematic



absolute maximum ratings over free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{CC+} - V_{CC-}$ (see Note 1) . . . . 5.5 V
Differential input voltage, V_{ID} (see Note 2) . . . . Supply voltage
Input voltage range, V_I (either input) . . . . V_{CC-} – 0.2 V to V_{CC+} + 0.2 V
Duration of output short circuit (one amplifier) to $V_{CC}\pm$ (see Notes 3 and 4) . . . . Unlimited
Package thermal impedance, θ_{JA} (see Notes 4 and 5): DBV package . . . . 165°C/W
DCK package . . . . 259°C/W
DGS package . . . . 165°C/W
RUG package . . . . 253°C/W
Operating virtual junction temperature, T_J . . . . 150°C
Storage temperature range, T_{stg} . . . . –65 to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES:
1. All voltage values (except differential voltages and V_{CC} specified for the measurement of I_{OS}) are with respect to the network GND.
2. Differential voltages are at IN+ with respect to IN−.
3. Applies to both single-supply and split-supply operation. Continuous short-circuit operation at elevated ambient temperature can result in exceeding the maximum-allowed junction temperature of 150°C. Output currents in excess of 45 mA over long term may adversely affect reliability.
4. Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
5. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT
V_{CC}	Supply voltage ($V_{CC+} - V_{CC-}$)	1.8	5	V
T_A	Operating free-air temperature	–40	125	°C

ESD protection

TEST CONDITIONS	TYP	UNIT
Human-Body Model	2000	V
Machine Model	200	V

electrical characteristics at T_A = 25°C, V_{CC+} = 1.8 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	LMV981 (single)		25°C		1	4	mV
				Full range			6	
		LMV982 (dual)		25°C		1	5.5	
				Full range			7.5	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		5.5		μV/°C
I_{IB}	Input bias current	V_{IC} = V_{CC+} – 0.8 V		25°C		15	35	nA
				25°C			65	
				Full range			75	
I_{IO}	Input offset current			25°C		13	25	nA
				Full range			40	
I_{CC}	Supply current (per channel)			25°C		103	185	μA
				Full range			205	
		In shutdown	LMV981	25°C		0.156	1	
				Full range			2	
			LM982	25°C		0.178	3.5	
				Full range			5	
CMRR	Common-mode rejection ratio	0 ≤ V_{IC} ≤ 0.6 V, 1.4 V ≤ V_{IC} ≤ 1.8 V		25°C	60	78		dB
				–40°C to 85°C	55			
		0.2 V ≤ V_{IC} ≤ 0.6 V, 1.4 V ≤ V_{IC} ≤ 1.6 V		–40°C to 125°C	55			
		–0.2 V ≤ V_{IC} ≤ 0 V, 1.8 V ≤ V_{IC} ≤ 2 V		25°C	50	72		
k_{SVR}	Supply-voltage rejection ratio	1.8 V ≤ V_{CC+} ≤ 5 V, V_{IC} = 0.5 V		25°C	75	100		dB
				Full range	70			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	V_{CC-} – 0.2	–0.2 to 2.1	V_{CC+} + 0.2	V
				–40°C to 85°C	V_{CC-}		V_{CC+}	
				–40°C to 125°C	V_{CC-} + 0.2		V_{CC+} – 0.2	
A_V	Large-signal voltage gain	LMV981	R_L = 600 Ω to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	77	101		dB
				Full range	73			
			R_L = 2 kΩ to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	80	105		
				Full range	75			
		LMV982	R_L = 600 Ω to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	75	90		
				Full range	72			
			R_L = 2 kΩ to 0.9 V, V_O = 0.2 V to 1.6 V, V_{IC} = 0.5 V	25°C	78	100		
				Full range	75			

electrical characteristics at T_A = 25°C, V_{CC+} = 1.8 V, V_{CC-} = 0 V, V_{IC} = V_{CC+}/2, V_O = V_{CC+}/2, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 0.9 V, V_{ID} = ±100 mV	High level	25°C	1.65	1.72		V
				Full range	1.63			
			Low level	25°C		0.077	0.105	
				Full range			0.12	
		R_L = 2 kΩ to 0.9 V, V_{ID} = ±100 mV	High level	25°C	1.75	1.77		
				Full range	1.74			
			Low level	25°C		0.024	0.035	
				Full range			0.04	
I_{OS}	Output short-circuit current	V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	4	8		mA
				Full range	3.3			
		V_O = 1.8 V, V_{ID} = –100 mV	Sinking	25°C	7	9		
				Full range	5			
T_{on}	Turn-on time from shutdown			25°C		19		μs
V_{SHDN}	Turn-on voltage to enable part			25°C		1.0		V
	Turn-off voltage					0.55		
GBW	Gain bandwidth product			25°C		1.4		MHz
SR	Slew rate	See Note 6		25°C		0.35		V/μS
Φ_m	Phase margin			25°C		67		deg
	Gain margin			25°C		7		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 0.5 V		25°C		60		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.06		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{PP}		25°C		0.023		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited in turn with a 1-kHz signal to produce V_O = 3 V_{PP}.

electrical characteristics at T_A = 25°C, V_{CC+} = 2.7 V, V_{CC-} = 0 V, V_{IC} = $V_{CC+}/2$, V_O = $V_{CC+}/2$, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	LMV981 (single)	25°C		1	4	mV
			Full range			6	
		LMV982 (dual)	25°C		1	5.5	
			Full range			7.5	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage		25°C		5.5		μV/°C
I_{IB}	Input bias current	$V_{IC} = V_{CC+} - 0.8$ V	25°C		15	35	nA
			25°C			65	
			Full range			75	
I_{IO}	Input offset current		25°C		8	25	nA
			Full range			40	
I_{CC}	Supply current (per channel)		25°C		105	190	μA
			Full range			210	
		In shutdown, LMV981	25°C		0.61	1	
			Full range			2	
		In shutdown, LM982	25°C		0.101	3.5	
			Full range			5	
CMRR	Common-mode rejection ratio	$0 \le V_{IC} \le 1.5$ V, $2.3\ V \le V_{IC} \le 2.7$ V	25°C	60	81		dB
			–40°C to 85°C	55			
		$0.2 \le V_{IC} \le 1.5$ V, $2.3\ V \le V_{IC} \le 2.5$ V	–40°C to 125°C	55			
		$-0.2\ V \le V_{IC} \le 0$ V, $2.7\ V \le V_{IC} \le 2.9$ V	25°C	50	74		
k_{SVR}	Supply-voltage rejection ratio	$1.8\ V \le V_{CC+} \le 5$ V, $V_{IC} = 0.5$ V	25°C	75	100		dB
			Full range	70			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB	25°C	$V_{CC-} - 0.2$	–0.2 to 3.0	$V_{CC+} + 0.2$	V
			–40°C to 85°C	V_{CC-}		V_{CC+}	
			–40°C to 125°C	$V_{CC-} + 0.2$		$V_{CC+} - 0.2$	
A_V	Large-signal voltage gain, LMV981	R_L = 600 Ω to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	87	104		dB
			Full range	86			
		R_L = 2 kΩ to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	92	110		
			Full range	91			
	Large-signal voltage gain, LMV982	R_L = 600 Ω to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	78	90		
			Full range	75			
		R_L = 2 kΩ to 1.35 V, V_O = 0.2 V to 2.5 V	25°C	81	100		
			Full range	78			

characteristics at T_A = 25°C, V_{CC+} = 2.7 V, V_{CC-} = 0 V, V_{IC} = $V_{CC+}/2$, V_O = $V_{CC+}/2$, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 1.35 V, V_{ID} = ±100 mV	High level	25°C	2.55	2.62		V
				Full range	2.53			
			Low level	25°C		0.083	0.11	
				Full range			0.13	
		R_L = 2 kΩ to 1.35 V, V_{ID} = ±100 mV	High level	25°C	2.65	2.675		
				Full range	2.64			
			Low level	25°C		0.025	0.04	
				Full range			0.045	
I_{OS}	Output short-circuit current	V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	20	30		mA
				Full range	15			
		V_O = 2.7 V, V_{ID} = −100 mV	Sinking	25°C	18	25		
				Full range	12			
T_{on}	Turn-on time from shutdown			25°C		12.5		μs
V_{SHDN}	Turn-on voltage to enable part			25°C		1.9		V
	Turn-off voltage					0.8		
GBW	Gain bandwidth product			25°C		1.4		MHz
SR	Slew rate	See Note 6		25°C		0.4		V/μS
Φ_m	Phase margin			25°C		70		deg
	Gain margin			25°C		7.5		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 0.5 V		25°C		57		$nV/\sqrt{Hz}$
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.082		$pA/\sqrt{Hz}$
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{PP}		25°C		0.022		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited in turn with a 1-kHz signal to produce V_O = 3 V_{PP}.

electrical characteristics at T_A = 25°C, V_{CC+} = 5 V, V_{CC-} = 0 V, V_{IC} = $V_{CC+}/2$, V_O = $V_{CC+}/2$, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	LMV981 (single)	25°C		1	4	mV
			Full range			6	
		LMV982 (dual)	25°C		1	5.5	
			Full range			7.5	
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage		25°C		5.5		µV/°C
I_{IB}	Input bias current	$V_{IC} = V_{CC+} - 0.8$ V	25°C		15	35	nA
			25°C			65	
			Full range			75	
I_{IO}	Input offset current		25°C		9	25	nA
			Full range			40	
I_{CC}	Supply current (per channel)		25°C		116	210	µA
			Full range			230	
		In shutdown, LMV981	25°C		0.201	1	
			Full range			2	
		In shutdown, LM982	25°C		0.302	3.5	
			Full range			5	
CMRR	Common-mode rejection ratio	$0 \le V_{IC} \le 3.8$ V, $4.6\ V \le V_{IC} \le 5$ V	25°C	60	86		dB
			–40°C to 85°C	55			
		$0.3 \le V_{IC} \le 3.8$ V, $4.6\ V \le V_{IC} \le 4.7$ V	–40°C to 125°C	55			
		$-0.2\ V \le V_{IC} \le 0$ V, $5\ V \le V_{IC} \le 5.2$ V	25°C	50	78		
k_{SVR}	Supply-voltage rejection ratio	$1.8\ V \le V_{CC+} \le 5$ V, $V_{IC} = 0.5$ V	25°C	75	100		dB
			Full range	70			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB	25°C	$V_{CC-} - 0.2$	–0.2 to 5.3	$V_{CC+} + 0.2$	V
			–40°C to 85°C	V_{CC-}		V_{CC+}	
			–40°C to 125°C	$V_{CC-} + 0.3$		$V_{CC+} - 0.3$	
A_V	Large-signal voltage gain, LMV981	R_L = 600 Ω to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	88	102		dB
			Full range	87			
		R_L = 2 kΩ to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	94	113		
			Full range	93			
	Large-signal voltage gain, LMV982	R_L = 600 Ω to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	81	90		
			Full range	78			
		R_L = 2 kΩ to 2.5 V, V_O = 0.2 V to 4.8 V	25°C	85	100		
			Full range	82			

electrical characteristics at T_A = 25°C, V_{CC+} = 5 V, V_{CC-} = 0 V, V_{IC} = $V_{CC+}/2$, V_O = $V_{CC+}/2$, R_L > 1 MΩ, and SHDN tied to V_{CC+} (unless otherwise noted) (continued)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output swing	R_L = 600 Ω to 2.5 V, V_{ID} = ±100 mV	High level	25°C	4.855	4.89		V
				Full range	4.835			
			Low level	25°C		0.12	0.16	
				Full range			0.18	
		R_L = 2 kΩ to 2.5 V, V_{ID} = ±100 mV	High level	25°C	4.945	4.967		
				Full range	4.935			
			Low level	25°C		0.037	0.065	
				Full range			0.075	
I_{OS}	Output short-circuit current	LMV981: V_O = 0 V, V_{ID} = 100 mV	Sourcing	25°C	80	100		mA
				Full range	68			
		V_O = 5 V, V_{ID} = –100 mV	Sinking	25°C	58	65		
				Full range	45			
T_{on}	Turn-on time from shutdown			25°C		8.4		µs
V_{SHDN}	Turn-on voltage to enable part			25°C		4.2		V
	Turn-off voltage					0.8		
GBW	Gain bandwidth product			25°C		1.5		MHz
SR	Slew rate	See Note 6		25°C		0.42		V/µS
Φ_m	Phase margin			25°C		71		deg
	Gain margin			25°C		8		dB
V_n	Equivalent input noise voltage	f = 1 kHz, V_{IC} = 1 V		25°C		50		nV/√Hz
I_n	Equivalent input noise current	f = 1 kHz		25°C		0.07		pA/√Hz
THD	Total harmonic distortion	f = 1 kHz, A_V = 1, R_L = 600 Ω, V_{ID} = 1 V_{PP}		25°C		0.022		%
	Amp-to-amp isolation	See Note 7		25°C		123		dB

NOTES: 6. Number specified is the slower of the positive and negative slew rates.
7. Input referred, V_{CC+} = 5 V and R_L = 100 kΩ connected to 2.5 V. Each amp is excited in turn with a 1-kHz signal to produce V_O = 3 V_{PP}.

TYPICAL PERFORMANCE CHARACTERISTICS

Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

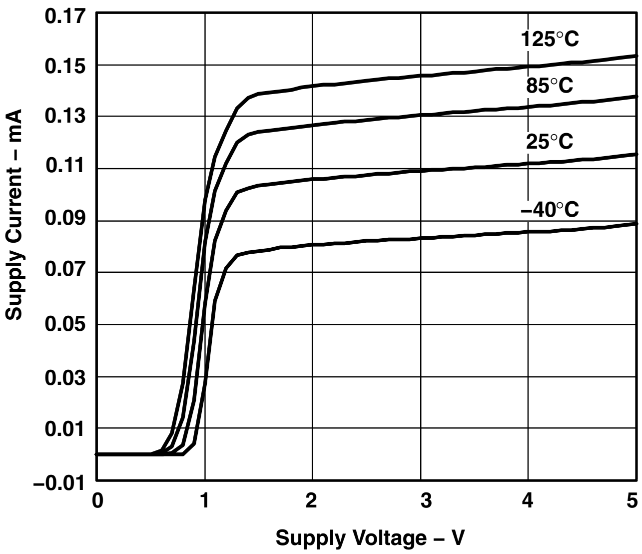


Figure 1

SLEW RATE
vs
SUPPLY VOLTAGE

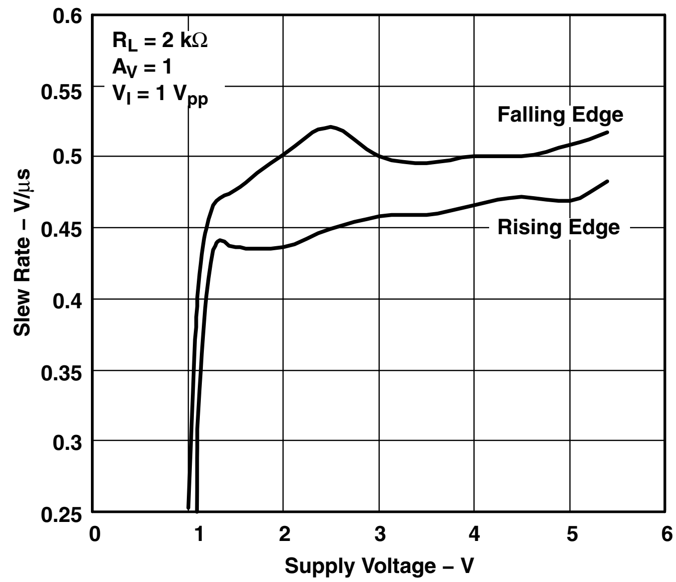


Figure 2

SOURCE CURRENT
vs
OUTPUT VOLTAGE

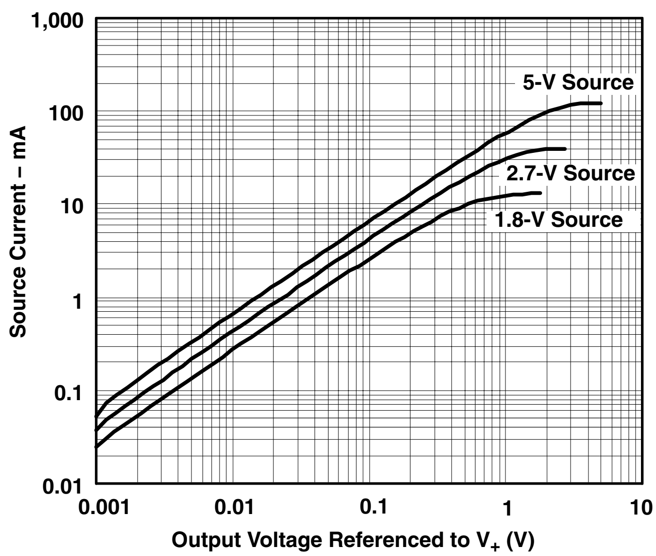


Figure 3

SINK CURRENT
vs
OUTPUT VOLTAGE

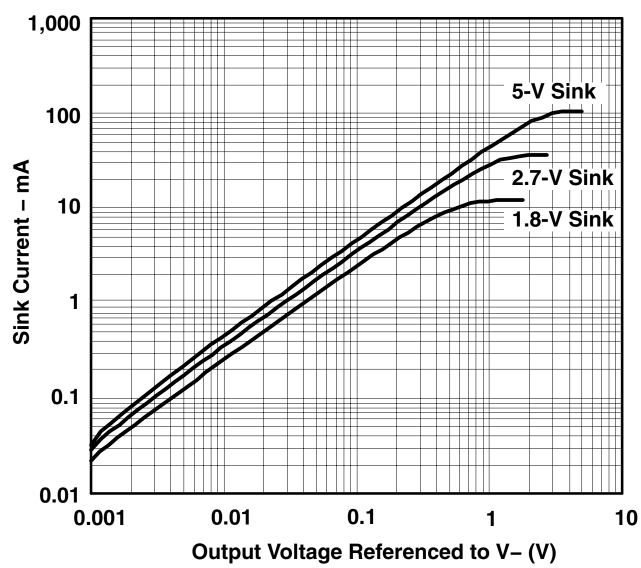


Figure 4

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

OUTPUT VOLTAGE SWING
vs
SUPPLY VOLTAGE

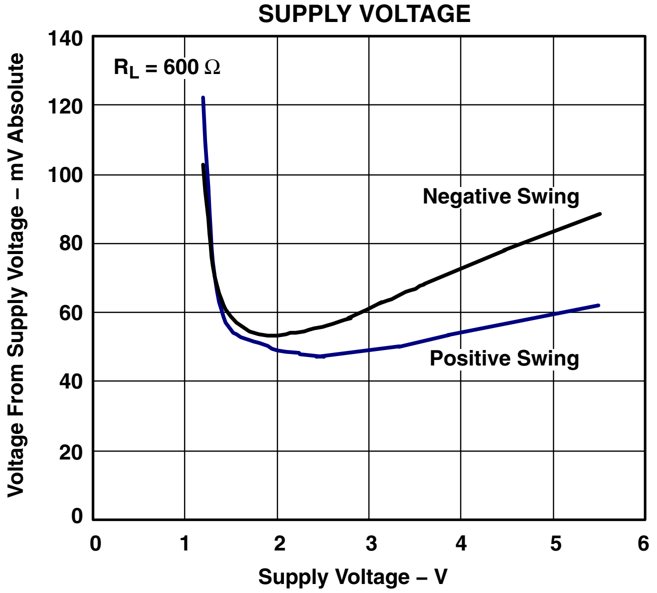


Figure 5

OUTPUT VOLTAGE SWING
vs
SUPPLY VOLTAGE

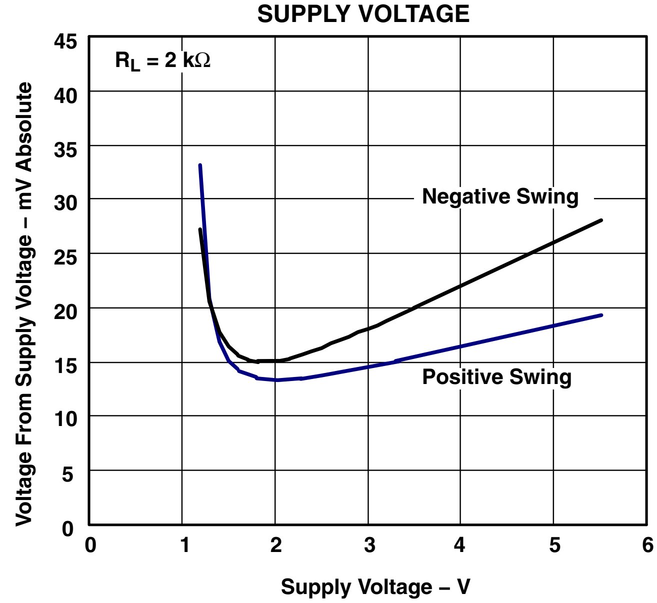


Figure 6

SHORT-CIRCUIT CURRENT (SINK)
vs
TEMPERATURE

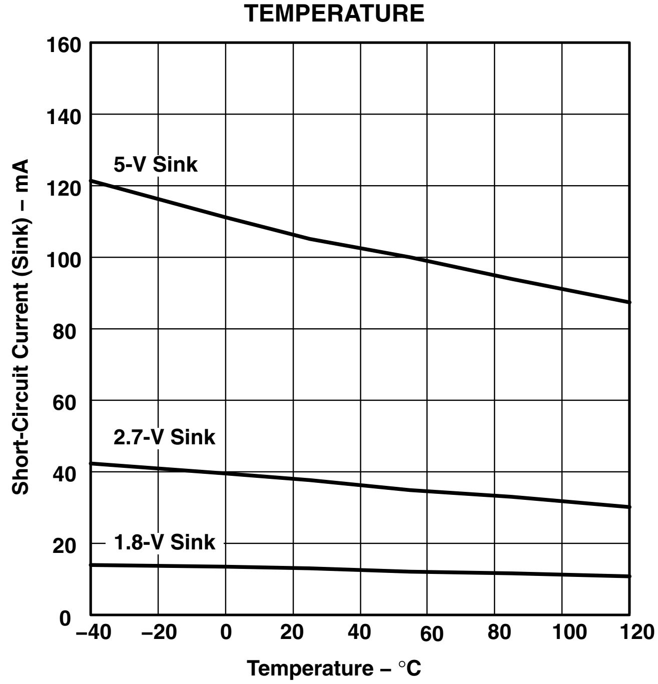


Figure 7

SHORT-CIRCUIT CURRENT (SOURCE)
vs
TEMPERATURE

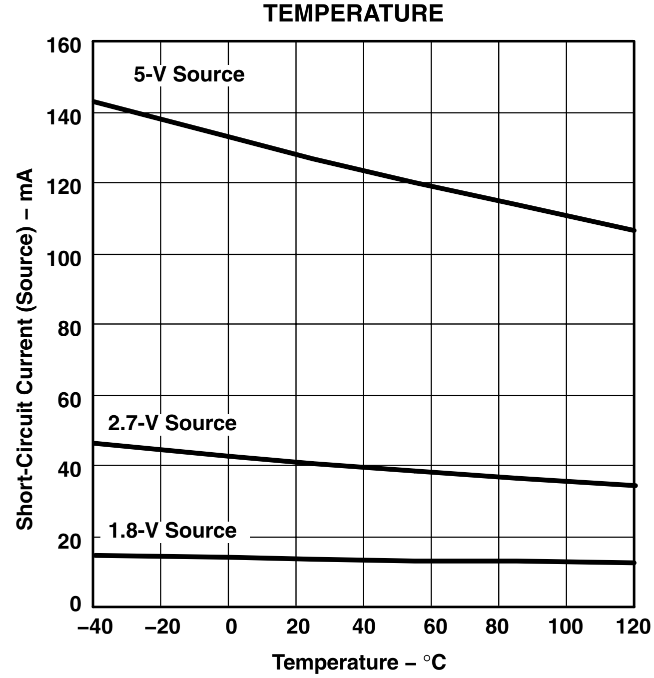


Figure 8

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

1.8-V FREQUENCY RESPONSE vs C_L

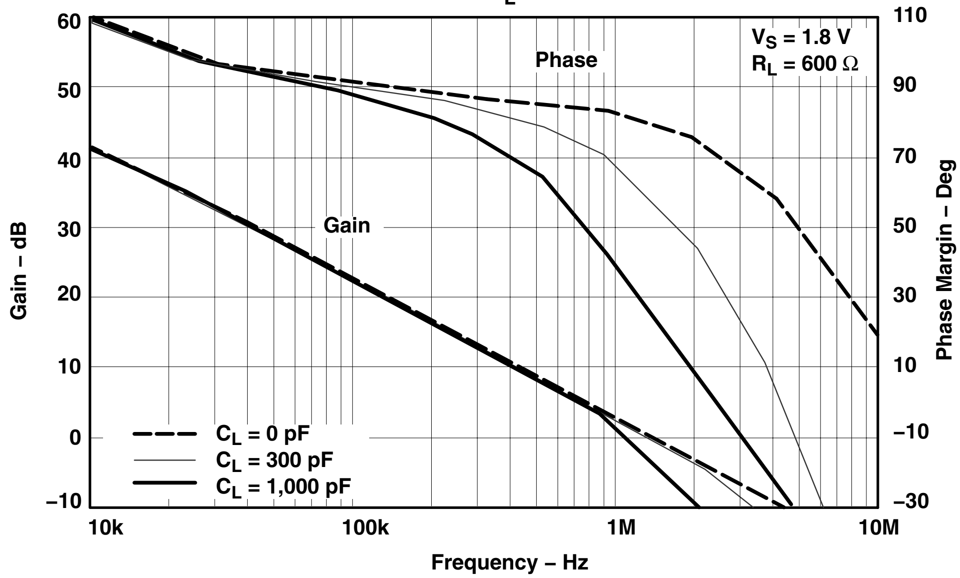


Figure 9

5-V FREQUENCY RESPONSE vs C_L

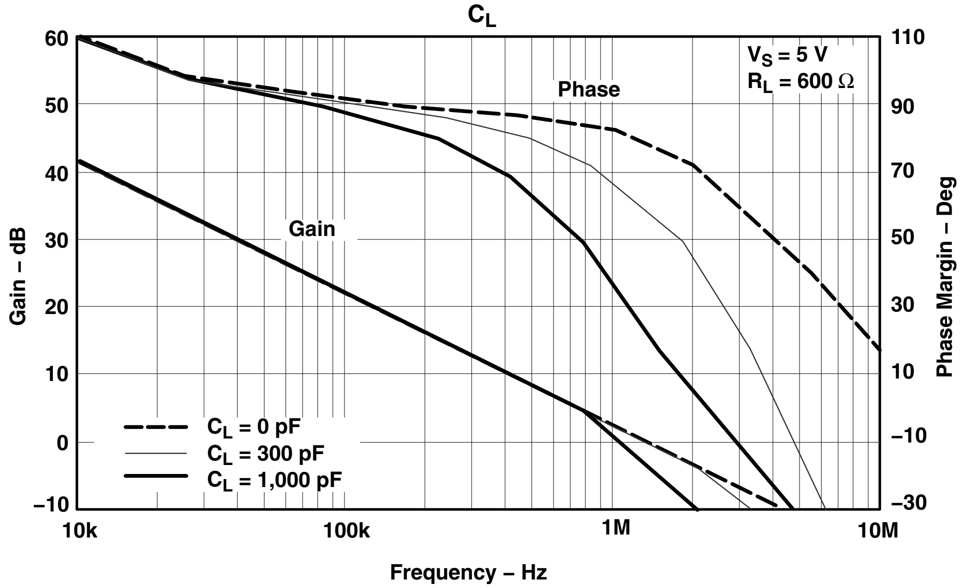


Figure 10

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

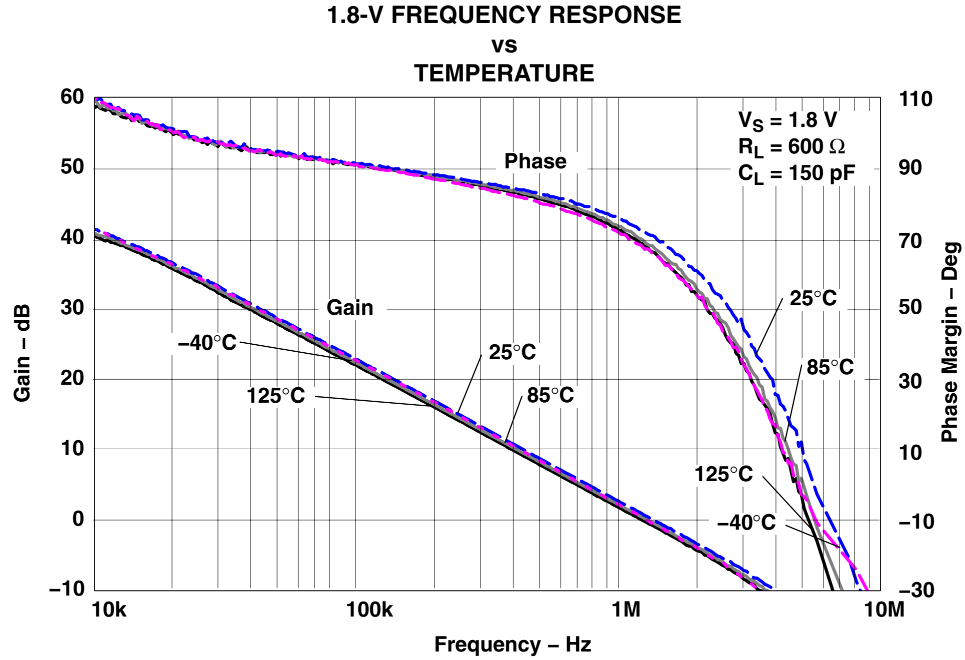


Figure 11

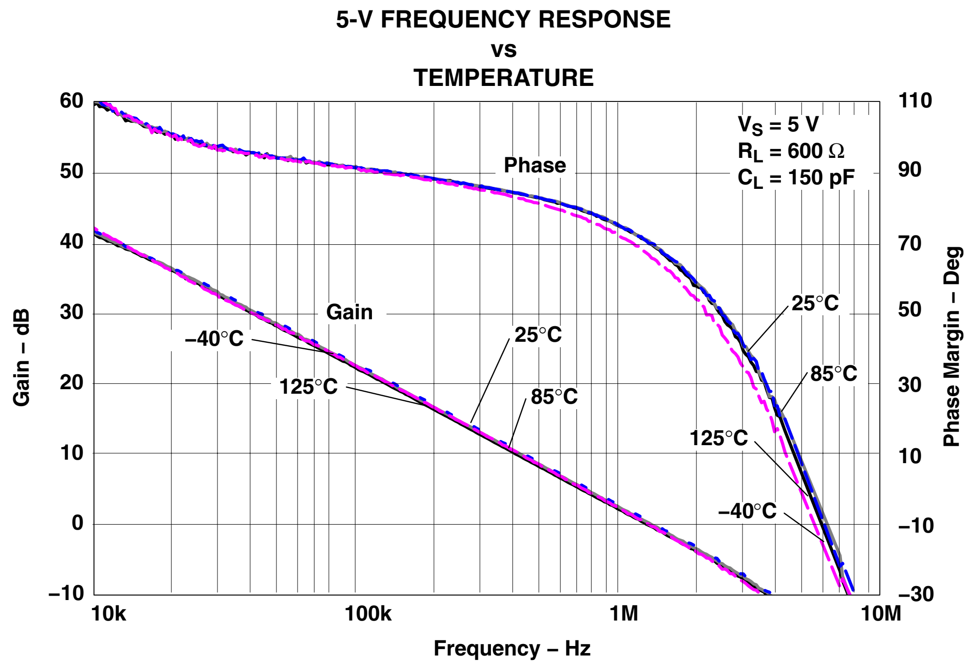


Figure 12

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

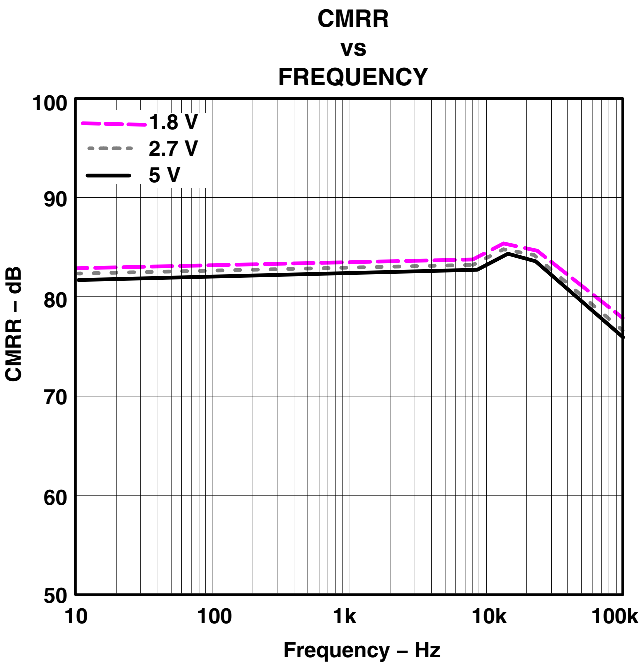


Figure 13

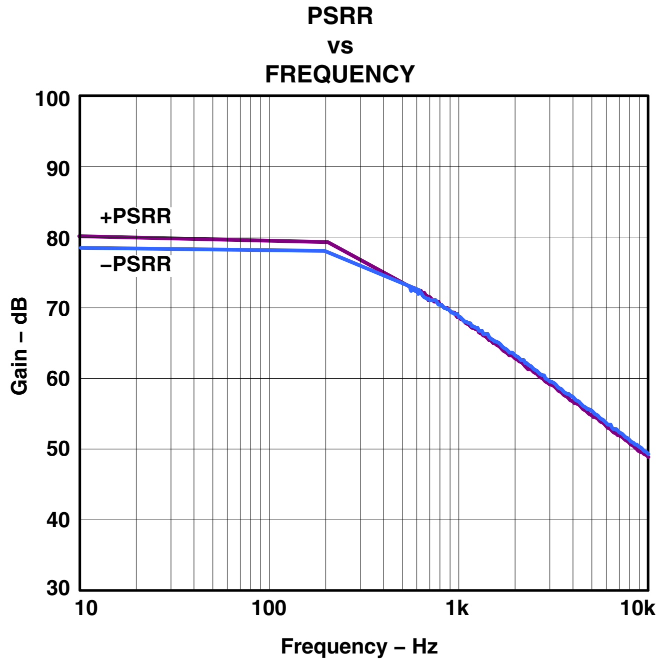


Figure 14

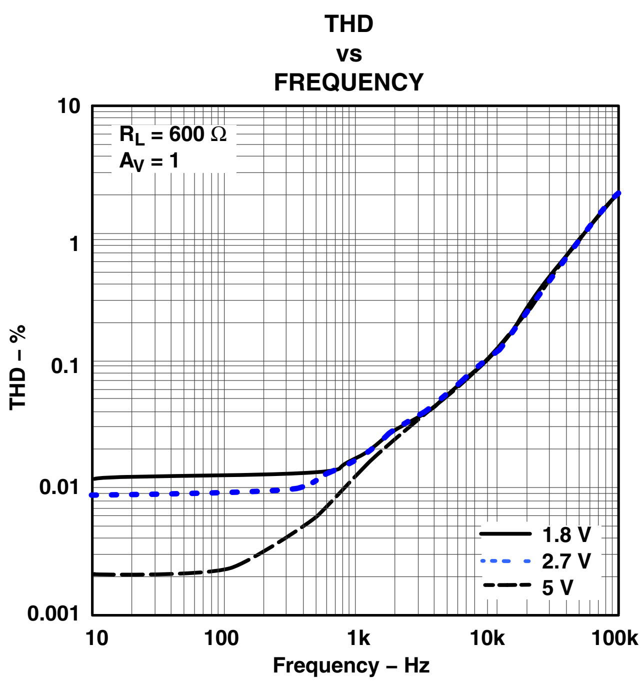


Figure 15

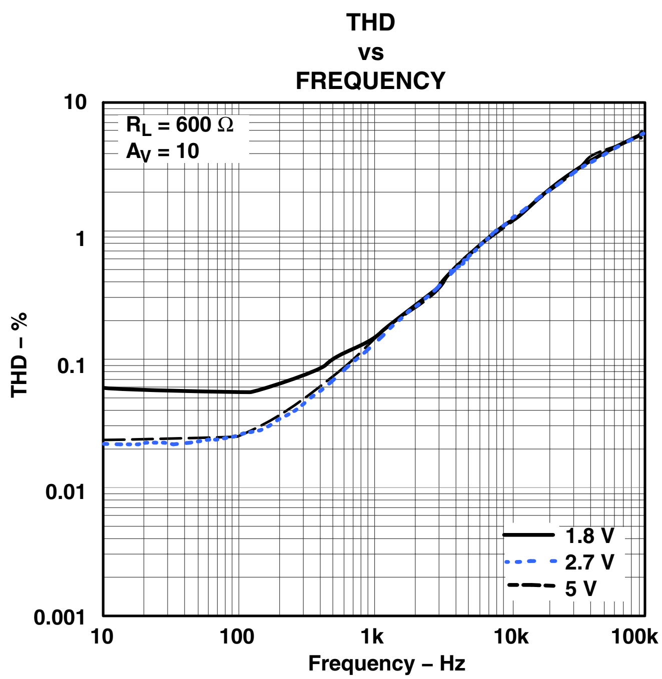


Figure 16

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

SMALL-SIGNAL NONINVERTING RESPONSE

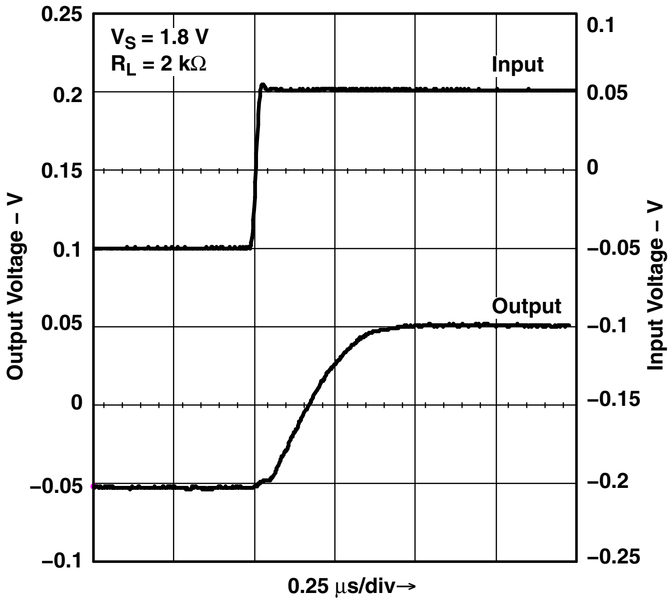


Figure 17

SMALL-SIGNAL NONINVERTING RESPONSE

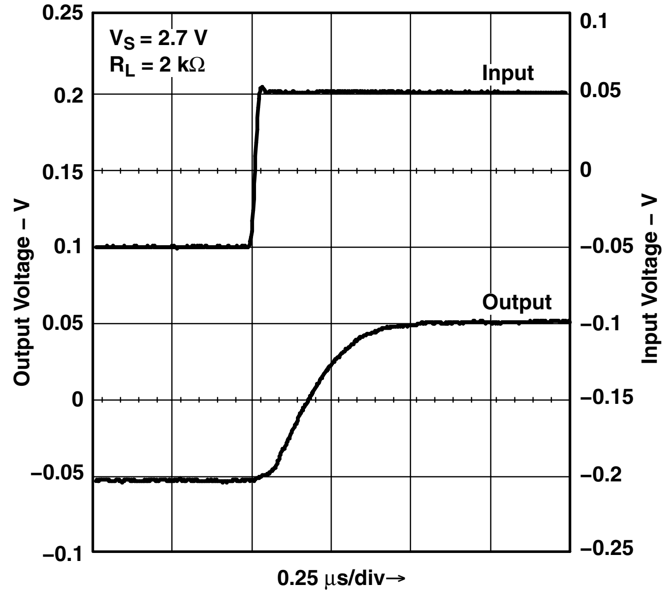


Figure 18

SMALL-SIGNAL NONINVERTING RESPONSE

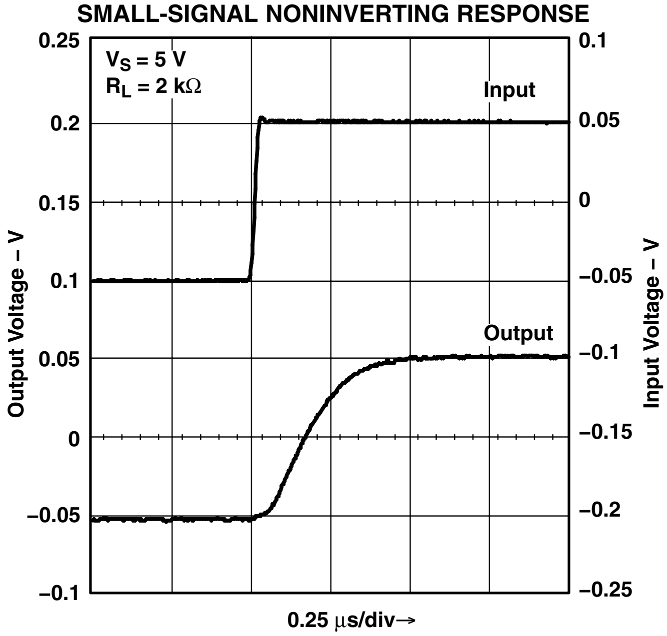


Figure 19

LARGE-SIGNAL NONINVERTING RESPONSE

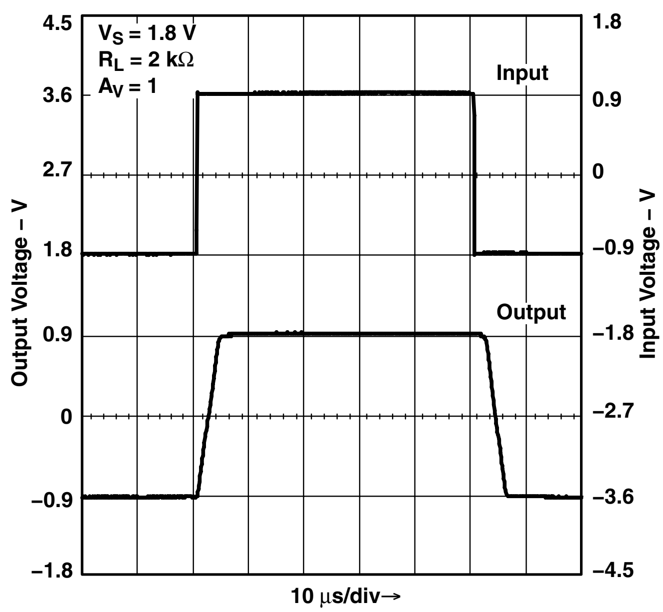


Figure 20

TYPICAL PERFORMANCE CHARACTERISTICS

Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

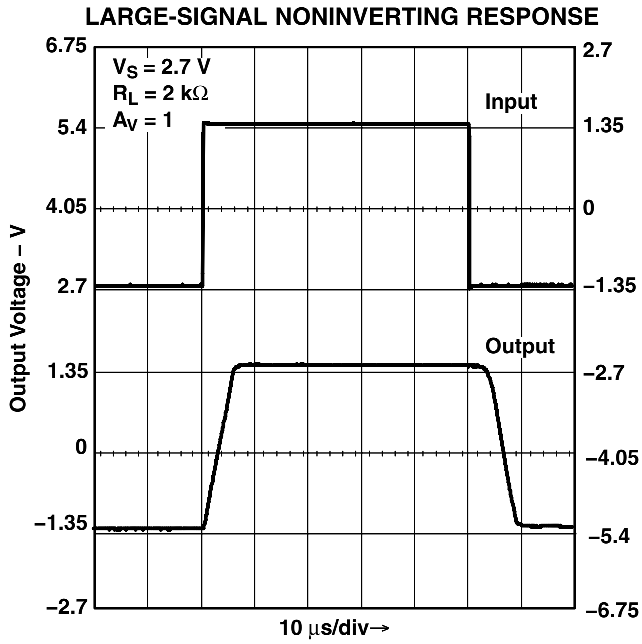


Figure 21

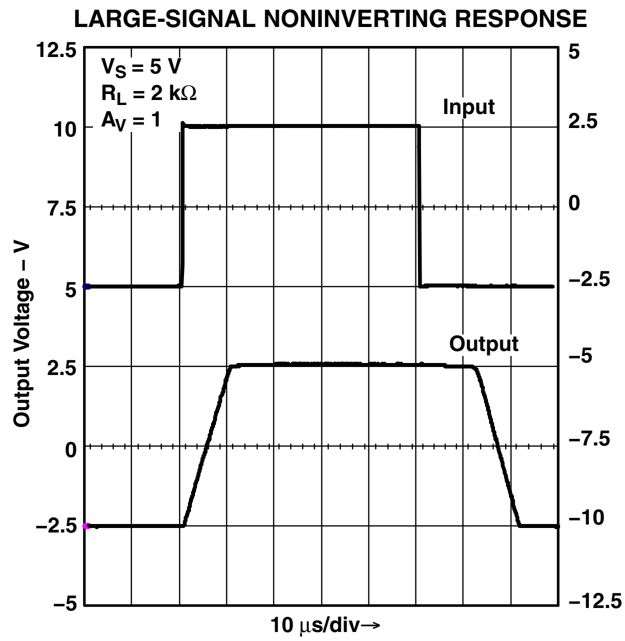


Figure 22

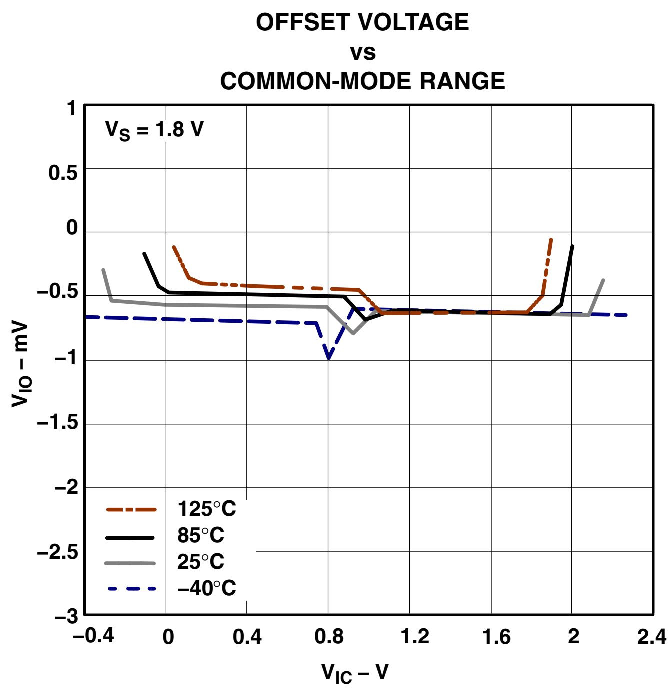


Figure 23

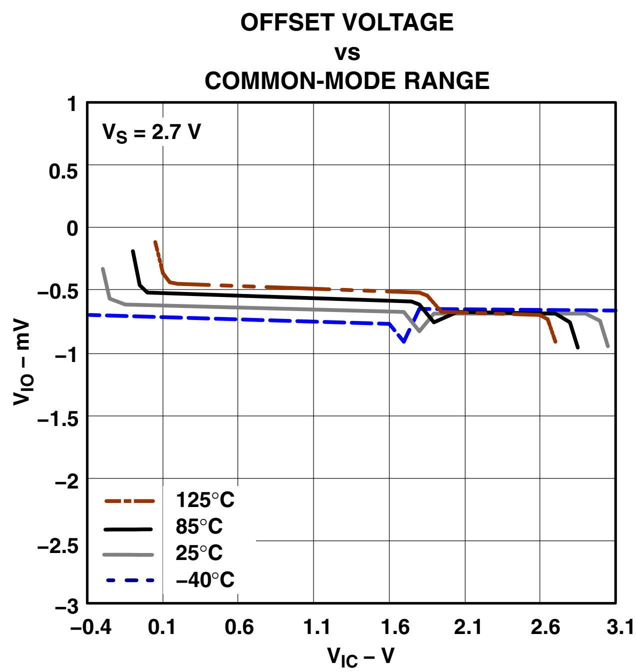


Figure 24

TYPICAL PERFORMANCE CHARACTERISTICS
Unless Otherwise Specified, V_{CC+} = 5 V, Single Supply, T_A = 25°C

OFFSET VOLTAGE
vs
COMMON-MODE RANGE

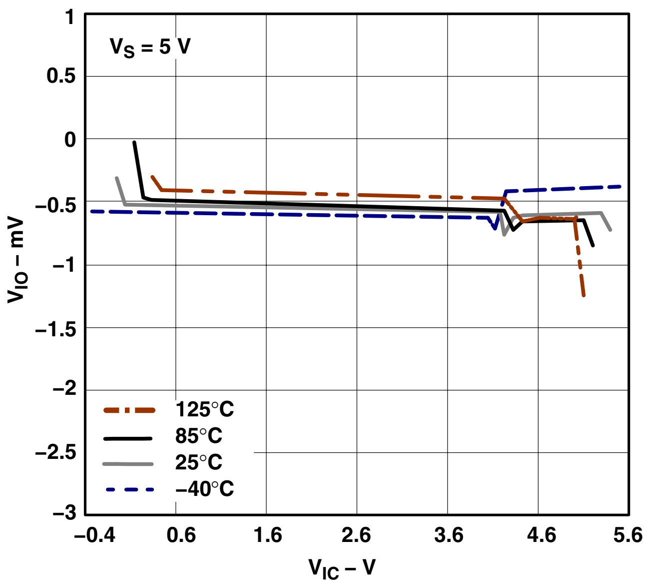


Figure 25

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LMV981IDBVR	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	
LMV981IDBVRE4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	
LMV981IDBVRG4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	
LMV981IDCKR	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	
LMV981IDCKRE4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	
LMV981IDCKRG4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	
LMV981IRUGR	OBSOLETE	X2QFN	RUG	8		TBD	Call TI	Call TI	
LMV981IRUGRG4	OBSOLETE	X2QFN	RUG	8		TBD	Call TI	Call TI	
LMV982IDGSR	OBSOLETE	VSSOP	DGS	10		TBD	Call TI	Call TI	
LMV982IDGSRE4	OBSOLETE	VSSOP	DGS	10		TBD	Call TI	Call TI	
LMV982IDGSRG4	OBSOLETE	VSSOP	DGS	10		TBD	Call TI	Call TI	

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

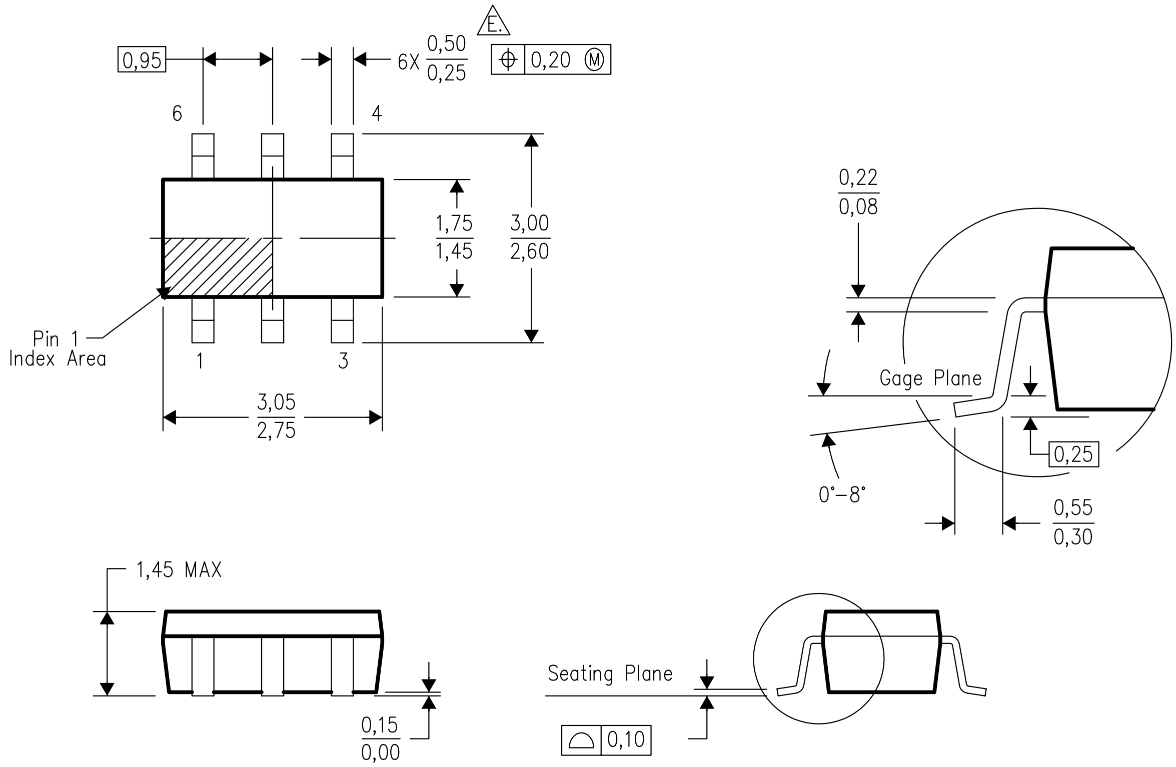
(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

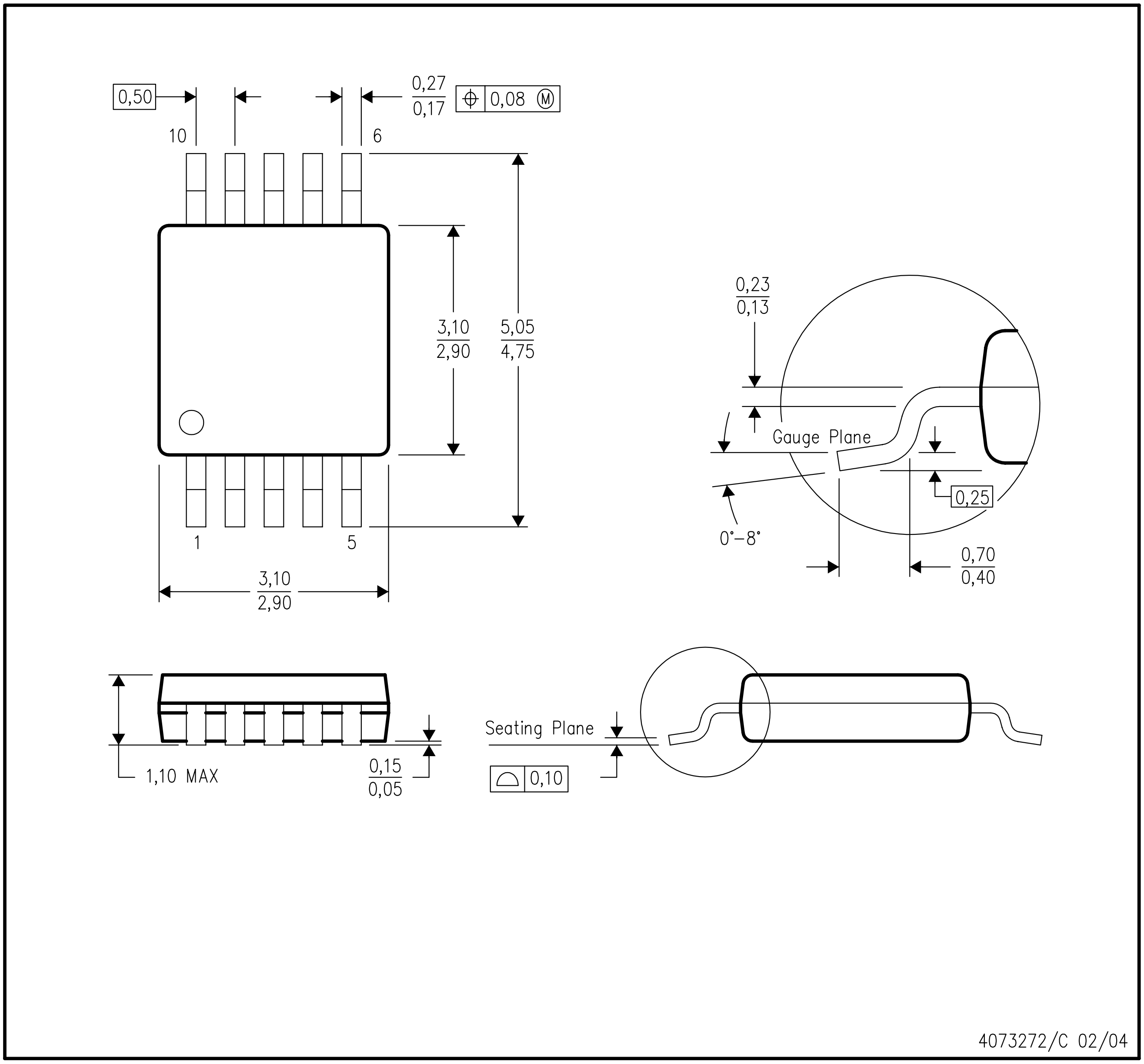
DBV (R-PDSO-G6) PLASTIC SMALL-OUTLINE PACKAGE



4073253-5/K 03/2006

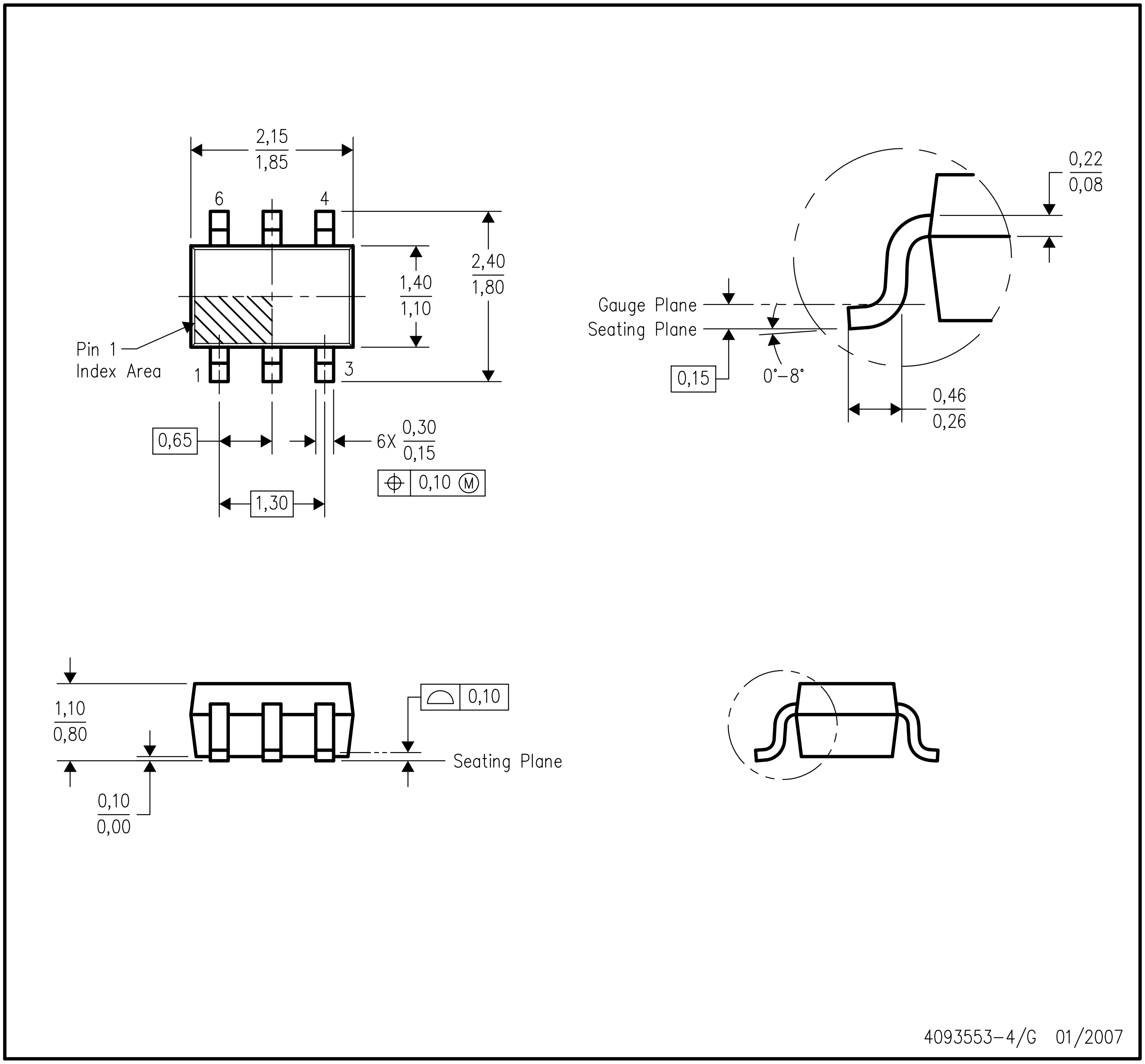
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
E. Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DGS (S-PDSO-G10) PLASTIC SMALL-OUTLINE PACKAGE



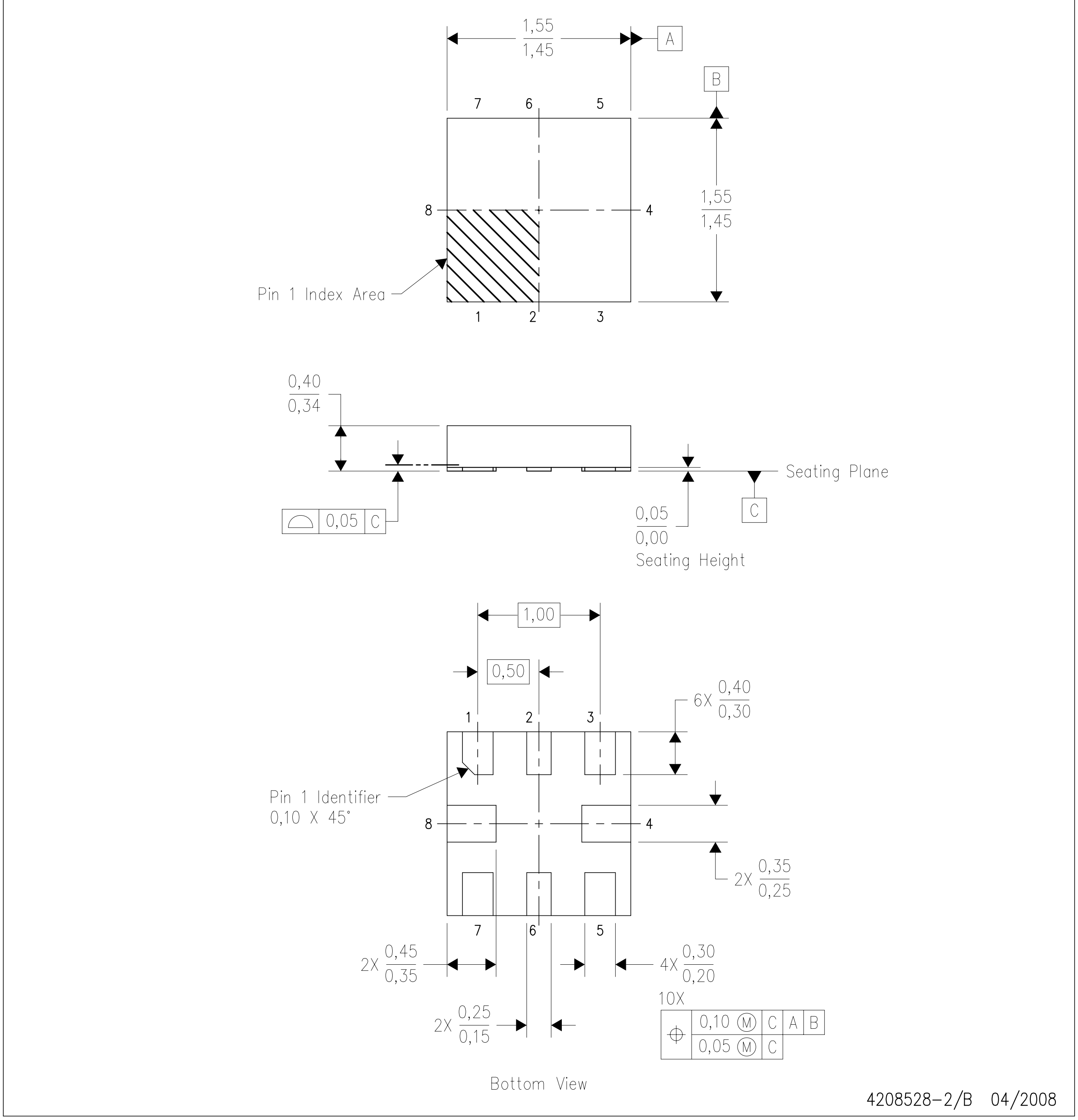
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO-187 variation BA.

DCK (R-PDSO-G6) PLASTIC SMALL-OUTLINE PACKAGE



NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AB.

RUG (S–PQFP–N8) PLASTIC QUAD FLATPACK



NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. QFN (Quad Flatpack No–Lead) package configuration.
D. This package complies to JEDEC MO–288 variation X2ECD.